

U.S. PATENT APPLICATION

OF

JOHN COOKER

FOR

ORAL DELIVERY SYSTEM AND METHOD OF MAKING SAME

1 ORAL DELIVERY SYSTEM AND METHOD FOR MAKING SAME

2

3 CROSS-REFERENCE TO RELATED APPLICATIONS

4 This application is a continuation-in-part and claims
5 the benefit of commonly owned and copending U.S. application
6 serial no. 09/614,243, filed July 12, 2000, which claimed
7 the benefit of commonly owned U.S. Provisional Application
8 Serial No. 60/151,901, filed September 1, 1999.

9

10 BACKGROUND OF THE INVENTION

11

12 COPYRIGHT NOTICE

13 © Copyright 2000, 2003 John T. Cooker.

14 All rights reserved.

15 A portion of the disclosure of this patent document
16 contains material that is subject to copyright protection.
17 The copyright owner has no objection to the facsimile
18 reproduction by anyone of the patent document or the patent
19 disclosure, as it appears in the U.S. Patent and Trademark
20 Office patent file or records, but otherwise reserves all
21 copyright rights whatsoever.

22 1. Field of the Invention

23 The present invention generally relates to an oral
24 delivery system.

1 2. Description of Related Art

2 The pharmaceutical industry has developed a variety of
3 medications, medicaments, vitamins, nutritional supplements,
4 etc. (collectively referred to herein as "oral dosages")
5 that can be taken orally and which are in the form of
6 capsules, tablets, gel caps and their like (collectively
7 referred to herein as "oral dosage forms"). However, many
8 consumers have experienced difficulty in swallowing such
9 oral dosage forms. Specifically, many types of commercially
10 available oral dosage forms become buoyant on the liquid
11 with which they are taken. This is especially the case with
12 capsules which are hardened reservoirs of gelatin filled
13 with powdered ingredients and air. As a result of such a
14 configuration, the powdered ingredients and air become
15 bubbles sealed in gelatin. The buoyancy of the oral dosage
16 forms on the liquid causes discomfort and creates difficulty
17 in swallowing. Specifically, the buoyancy characteristic
18 creates the following problems:

19 1) the buoyancy of the oral dosage
20 form works against the downward motion
21 of swallowing and also reduces control
22 of the oral dosage form by the tongue
23 and pharynx muscles;

1 2) the dry gelatin outer surface of
2 a capsule or gel cap, when wetted,
3 quickly becomes sticky and easily
4 adheres to surfaces it contacts. As a
5 result, the oral dosage form may be left
6 behind as it follows the liquid down the
7 pharynx and esophagus thereby requiring
8 successive swallows of additional liquid
9 to flush down the oral dosage form; and

10 3) a capsule, while floating on
11 the liquid, may move out of its
12 intended aligned position in which the
13 narrow end of its cylindrical shape
14 points toward the pharynx and esophagus
15 and as a result, is swallowed at an
16 uncomfortable angle, possibly becoming
17 lodged in the process.

18 Oral dosage forms that have a cylindrical, oval or
19 rectangular shape (but not round), and which are not heavy
20 enough to sink in the liquid with which they are taken may
21 move out of their aligned position while being propelled by
22 the tongue toward the pharynx and esophagus thereby being
23 swallowed at an uncomfortable angle.

1 The pharmaceutical industry has attempted to solve these
2 problems by developing various oral dosage forms that
3 supposedly have improved swallowability. In their attempt to
4 solve the aforementioned problem relating to swallowability,
5 the pharmaceutical industry has focused on the size, shape
6 and surface composition of the capsules, tablets, gel caps,
7 etc. In another attempt to address the problem of
8 swallowability, the industry developed and produced
9 cylindrical-shaped tablets which were to replace round
10 shaped tablets, (i.e. a capsule shaped tablet). One result
11 of the pharmaceutical industry's attention to this problem
12 was the development of the gelatin-coated caplets or tablets
13 which not only addressed the problems relating to
14 swallowability but also consumers' wariness of capsule
15 tampering. Such a caplet is disclosed in U.S. Patent No.
16 5,314,537. Although the gelatin-coated caplet has provided
17 improvement in the swallowability of such caplets, the
18 pharmaceutical industry's attempts to solve this problem are
19 basically limited to the application of coatings to the
20 exterior of the caplet, tablet, etc.

21 The prior art discloses several oral dosage forms, and
22 drug delivery devices. Wong et al. U.S. Patent No.
23 5,198,229 describes a fluid-imbibing drug delivery device
24 having a first, low density such that it floats in the

1 stomach contents for a predetermined prolonged period of
2 time during which it dispenses a drug or other active agent
3 to the stomach. This drug delivery device also has a
4 second, higher density such that the device exits the
5 stomach at the end of the predetermined prolonged period of
6 time. The drug delivery device disclosed in Wong et al. has
7 two chambers. One of these chambers is a buoyancy chamber.
8 Due to the buoyancy chamber, the Wong et al. drug delivery
9 device, in its first stage, floats on stomach fluids. The
10 Wong et al. drug delivery device achieves density by release
11 of air in the outer chamber. Therefore, the drug delivery
12 device described in Wong et al. certainly cannot facilitate
13 swallowing if it is configured to float first on liquids.
14 Sharma et al. U.S. Patent No. 4,894,233 discloses a drug
15 delivery system comprising a core material comprising a
16 drug, and a hydrophobic matrix coating the core. The
17 coating delays hydration of the drug and masks the taste of
18 the drug. The coating comprises an emulsifier, an edible
19 fatty acid or wax and a glyceride. However, the use of
20 fatty acids or waxes significantly increases the buoyancy of
21 the drug delivery system. Such buoyancy can create
22 difficulty in swallowing the drug delivery system.
23 Eckenhoff U.S. Patent No. 5,098,425 describes a ruminant
24 dispensing device that comprises a density member or weight

1 means that is dispersed in a hydrogel member. The
2 dispensing device described in Eckenhoff is a time released
3 dispenser which uses metals as densifying agents. Examples
4 of such densifying agents described in Eckenhoff are iron,
5 iron shot, iron shot coated with iron oxide, iron shot
6 magnesium alloy, steel, stainless steel, copper oxide, a
7 mixture of cobalt oxide and iron powder, a mixture of iron
8 and copper oxide and the like. These metals are passed out
9 of the animal's body. Such metal densifying agents or
10 weight means are obviously not digestible and are clearly
11 not suited for use by humans.

12 Despite the developments discussed above, consumers
13 still continue to express desire for oral dosage forms that
14 exhibit improved swallowability characteristics.

15

16 SUMMARY OF THE INVENTION

17 It is therefore an object of the present invention to
18 provide new and improved oral dosage forms that solve the
19 aforementioned problems. Thus, the present invention is
20 directed to improved oral dosage forms that are
21 significantly easier to swallow. In accordance with the
22 present invention, the oral dosage forms are configured to
23 have relatively greater weight and/or density to effect
24 partial or total submergence in the liquid with which the

1 oral dosage form is taken. The oral dosage form has a size
2 that conforms to a size that can be comfortably swallowed.

3 In one embodiment, the present invention is directed to
4 an oral dosage form for ingestion with liquid, comprising,
5 an active ingredient, an inactive ingredient, and a
6 substance having a predetermined weight that effects at
7 least partial sinking of the oral dosage form in the liquid.
8 In a preferred embodiment, the substance is digestible. In
9 one embodiment, the substance is a digestible filler
10 material that is added to the active and inactive
11 ingredients of the oral dosage form. In such an embodiment,
12 the filler material is within the interior of the oral
13 dosage form. In another embodiment, the filler material is
14 added to the exterior of the oral dosage form. In a
15 preferred embodiment, the filler material is digestible. In
16 a preferred embodiment, the oral dosage form is configured
17 so that at least the portion of the oral dosage form that
18 has the filler (i.e. the weighted end of the oral dosage
19 form) sinks below the surface of the liquid with which the
20 oral dosage is taken.

21 In another embodiment of the invention, the substance
22 is a binder that is used to increase the weight and/or
23 density of the oral dosage form. In a preferred embodiment,
24 the binder is digestible.

1 In accordance with one embodiment of the invention, the
2 oral dosage form comprises a capsule that has a body portion
3 and a cap portion, and the filler material is placed in the
4 cap portion. In accordance with another embodiment of the
5 invention, the oral dosage form comprises a capsule that has
6 a body portion and a cap portion and the filler material is
7 placed in the body portion. Other embodiments of the
8 invention are possible as well. For example, a relatively
9 heavier, denser or larger amount of active and inactive
10 ingredients are used to formulate the oral dosage form. In
11 another example, a combination of a binder and a relatively
12 heavier, denser or larger amount of ingredient is used to
13 formulate the oral dosage form.

14 In a preferred embodiment, the oral dosage form of the
15 present invention does not utilize fatty acids, oils or
16 waxes so as not to cause an increase in the buoyancy of the
17 oral dosage form of the present invention. In a preferred
18 embodiment, the oral dosage form of the present invention is
19 configured to substantially eliminate the formation of any
20 air pockets or air chambers so as to decrease the buoyancy
21 of the oral dosage form.

22 Thus, in one aspect, the present invention is directed
23 to an oral dosage form for swallowing with liquid,
24 comprising an active ingredient, an inactive ingredient, and

1 a digestible substance having a predetermined weight that
2 effects at least partial sinking of the oral dosage form in
3 the liquid. The active ingredient and inactive ingredient
4 have a combined total weight that is substantially less than
5 the predetermined weight of the digestible substance. In
6 one embodiment, the oral dosage form comprises a capsule
7 having a first end and a second end, and the active and
8 inactive ingredients and the digestible substance are
9 compressed within the capsule. The digestible substance is
10 concentrated at the first end of the capsule so that when a
11 user desires to ingest the capsule, the buoyancy of the
12 capsule is substantially reduced and the capsule is aligned
13 so that the first end of the capsule points in the direction
14 of the pharynx and the second end of the capsule points in
15 the direction of the mouth thereby substantially reducing
16 the probability of the capsule being swallowed at an
17 uncomfortable angle.

18
19

BRIEF DESCRIPTION OF THE DRAWINGS

20 The features of the invention are believed to be novel.
21 The figures are for illustration purposes only and are not
22 drawn to scale. The invention itself, however, both as to
23 organization and method of operation, may best be understood

1 by reference to the detailed description which follows taken
2 in conjunction with the accompanying drawings in which:

3 FIG. 1 is perspective view of a capsule configured in
4 accordance with one embodiment of the present invention
5 wherein a filler is added to the capsule.

6 FIG. 2 is a perspective view of a capsule in accordance
7 with another embodiment wherein the capsule has indicia
8 thereon to indicate the portion of the capsule having
9 concentrated weight.

10 FIG. 3 is a perspective view of a capsule configured in
11 accordance with a further embodiment of the present
12 invention wherein filler granules are added to the capsule.

13 FIG. 4 is a perspective view of a capsule configured in
14 accordance with yet another embodiment of the present
15 invention wherein a single piece of filler is added to the
16 capsule.

17 FIG. 5 is a perspective view of a capsule configured in
18 accordance with a further embodiment of the present
19 invention wherein the filler is attached or adhered to the
20 exterior of the capsule.

21 FIG. 6 is a perspective view of a capsule configured in
22 accordance with yet another embodiment of the present
23 invention wherein the filler is molded into one of the
24 capsule portions.

1 FIG. 7 is top plan view, partially in cross-section, of
2 a tablet configured in accordance with one embodiment of the
3 present invention wherein a tablet is embedded in a filler.

4 FIG. 8 is a top plan view, partially in cross-section,
5 of a softgel configured in accordance with one embodiment of
6 the present invention wherein a filler is embedded in one
7 portion of the softgel.

8 FIG. 9 is a perspective view of a conical-shaped tablet
9 configured in accordance with a further embodiment of the
10 present invention wherein a filler substance is dispersed
11 throughout the tablet.

12 FIG. 10 is a top plan view of a generally trapezoidal-
13 shaped tablet having filler dispersed throughout the tablet.

14 FIGS. 11 and 12 are perspective views of a capsule in
15 accordance with another embodiment of the present invention
16 wherein a densifying substance is configured as a plug that
17 is attached to one end of the capsule.

18 FIG. 13 is a perspective view of a capsule in
19 accordance with another embodiment of the present invention
20 wherein the filler is located in the cap portion of the
21 capsule.

22 FIG. 14 is a table that shows typical commercially
23 available capsule sizes and corresponding capsule volumes.

1 FIG. 15 is a table that shows specific filler weights,
2 filler volumes and corresponding capsule sizes in accordance
3 with the present invention.

4 FIG. 16 is a standardization table in accordance with
5 the present invention.

6 FIG. 17 is a table that shows new capsule sizes, the
7 amount of additional filler that can be added to the new
8 capsules and the resulting total filler weight, in
9 accordance with the present invention.

10 FIGS. 18A, 18B and 18C show a conversion table, in
11 accordance with the present invention, which shows initial
12 capsule sizes and various powder density and weights that
13 can be achieved with each particular initial size capsule,
14 and new capsule sizes and the various total densities and
15 weights that can be achieved with each new capsule size.

16

17 DETAILED DESCRIPTION OF THE INVENTION

18 In describing the preferred embodiments of the present
19 invention, reference will be made herein to FIGS. 1-18C of
20 the drawings in which like numerals refer to like features
21 of the invention.

22 Oral dosage forms have a variety of physical
23 characteristics. One such physical characteristic is the
24 medium used for transport. Thus, the present invention

1 teaches a variety of configurations of oral dosage forms and
2 methods for making these oral dosage forms, that solve the
3 aforementioned problems and deficiencies associated with
4 conventional oral dosage forms. The configurations and
5 methods of the present invention are applicable to the three
6 major types of oral dosage forms: (1) capsules, (2) tablets
7 and caplets, and (3) soft-gels.

8 It has been found that by increasing the weight of oral
9 dosage forms, unexpected superior results are achieved in
10 that the swallowability of the oral dosage forms is
11 significantly improved. In particular, it has been found
12 that an oral dosage form configured to have a relatively
13 greater weight than that of a conventional, but same type,
14 oral dosage form, has significantly improved swallowability
15 characteristics. Specifically, the "weighted" oral dosage
16 form results in a significantly greater gravitational force
17 being exerted upon the oral dosage form which facilitates
18 direct and relatively quicker passage of the oral dosage
19 form through the pharynx and into the stomach.

20 It has also been found that increasing the density of
21 oral dosage forms, unexpected superior results are achieved
22 in that the swallowability of the oral dosage forms is
23 significantly improved. In particular, it has been found
24 that an oral dosage form configured to have a relatively

1 greater density than that of a conventional, but same type,
2 oral dosage form has significantly improved swallowability
3 characteristics. Specifically, the oral dosage form having
4 the greater density has significantly less buoyancy with
5 respect to the liquid which is taken with the oral dosage
6 form. As is described in the foregoing discussion, it is
7 buoyancy that resists the swallowing process. Thus, by
8 significantly reducing buoyancy of the oral dosage form, the
9 swallowability of the oral dosage form is greatly enhanced.

10 It also has been found that increased weight and/or
11 density concentrated at a particular end or side of an oral
12 dosage form maintains the oral dosage form in a preferred
13 and intended alignment by vertically positioning the oral
14 dosage form as it is swallowed. The heavier end of the oral
15 dosage form is positioned such that it points generally in
16 the direction of the pharynx and the lighter end points
17 generally toward the mouth. As a result, swallowability of
18 the oral dosage form is significantly enhanced because the
19 probability of the oral dosage form being swallowed at an
20 uncomfortable angle is significantly reduced.

21 In accordance with one embodiment of the invention, the
22 increased weight and/or density concentrated at a particular
23 end or side of the oral dosage form of the present invention
24 is such as to cause the oral dosage form to sink entirely in

1 the liquid which is taken with the oral dosage form while
2 maintaining the vertical alignment of the oral dosage form
3 as discussed above. In accordance with another embodiment
4 of the present invention, the increased weight and/or
5 density concentrated at a particular end or side of the oral
6 dosage form of the present invention is such as to cause the
7 oral dosage form to partially sink in the liquid while
8 maintaining the vertical alignment of the oral dosage form
9 as discussed above.

10 As described above, in one embodiment of the present
11 invention, a filler substance is added to the ingredients of
12 the oral dosage form. The filler may be in solid, semi-
13 solid, liquid or powder form. Furthermore, the filler may
14 be inactive or may provide an active function, e.g.
15 digestive aid. The filler can be formulated from any
16 accepted pharmaceutical excipient materials, whether soluble
17 or insoluble. Such excipient materials include sucrose,
18 dextrose, lactose, fructose, microcrystalline cellulose,
19 calcium carbonate, sorbitol, xylitol, isomalt, gelatin, and
20 starches. However, it is to be understood that these
21 aforementioned fillers are just examples and that other
22 types of commercially available fillers can be used as well.
23 The filler can be added at any convenient time during the
24 filling process. In one embodiment, the filler material

1 comprises solid sucrose granules that are added to the
2 ingredients of an oral dosage form. In another embodiment,
3 a solid sucrose portion is molded or adhered to the inside
4 of an oral dosage form. In a further embodiment, the filler
5 is applied as a relatively thick shell of sorbitol to the
6 oral dosage form.

7 In accordance with one embodiment of the present
8 invention, the filler is located in or at a particular
9 portion of the oral dosage form so as to provide a weighted
10 portion or a high-density portion. Thus, the weighted or
11 high-density portion of the oral dosage form is relatively
12 heavier than the remaining portion of the oral dosage form
13 thereby causing the weighted or high-density portion to sink
14 first in the liquid taken with which the oral dosage form is
15 taken. The oral dosage form becomes vertically positioned
16 within the liquid as a result of the weighted or high-
17 density portion sinking first. In a preferred embodiment,
18 the oral dosage form has indicia thereon to indicate which
19 portion of the oral dosage form is the weighted portion. In
20 the case of capsules, the indicia enables a consumer to
21 align the weighted or heavier portion of the capsule in his
22 or her mouth so as to use the capsule's cylindrical shape to
23 facilitate correct alignment of the capsule and movement of
24 the capsule through the throat and into the esophagus

1 thereby reducing the chance that the oral dosage form will
2 be swallowed at an angle that causes discomfort. As a
3 result, confidence is instilled in the consumer when using
4 the oral dosage form. In one embodiment, color is used as
5 indicia to indicate the weighted portion of the oral dosage
6 form.

7 In accordance with another embodiment of the invention,
8 the oral dosage form may be configured such that the filler
9 is part of the medium. In the case of a capsule, the filler
10 is part of the capsule, either the body portion, cap
11 portion, or both. In another embodiment, the filler is
12 deposited on or disposed over the exterior surface of the
13 medium of the oral dosage form. In one such embodiment, the
14 filler is coated over the exterior surface of the medium of
15 the oral dosage form. In another embodiment, a filler
16 coating is applied to the exterior surface of the medium by
17 dipping the oral dosage form in a liquid filler and then
18 allowing sufficient time for curing and drying. In a
19 preferred embodiment, the thickness of such a filler coating
20 is between about 20 and 200 mils, inclusive.

21 In a further embodiment, a relatively heavier or denser
22 diluent is used as an ingredient of the oral dosage form.
23 In particular, a portion of a powdered diluent used to bulk
24 the volume of a capsule containing a small dosage of

1 ingredients is replaced with solid granules in order to
2 increase the weight and/or density. In one example, rice
3 flour in solid granule form is used. Rice flour in solid
4 granule form has a relatively greater density or weight and
5 as a result, can be used in the same available oral dosage
6 form volume thereby providing a relatively heavier and
7 denser oral dosage form.

8 In another embodiment, a binder is used to provide a
9 relatively denser oral dosage form. Conventional capsules
10 are typically filled with free flowing ingredients in powder
11 form. However, conventional capsules do not use binders to
12 adhere the free flowing ingredients. In accordance with
13 another embodiment of the present invention, a binder is
14 mixed with a portion of a capsule's ingredients in order to
15 provide a significant increase in the density of the oral
16 dosage form. In one embodiment, a starch binder is mixed
17 with a portion of ingredients to form solids or semi-solids
18 which, when dried and combined with the remaining
19 ingredients, form a relatively high-density oral dosage
20 form. As a result, a smaller capsule can be used, or a
21 relatively larger amount of ingredients can be used in the
22 original capsule. This process of binding a portion of the
23 ingredients of a capsule requires relatively less effort
24 than producing a complete tablet of all the ingredients and

1 the resulting oral dosage form still retains the
2 characteristics of a capsule, e.g. the capsule's shiny,
3 smooth surface.

4 In another embodiment, relatively large amounts of
5 diluent and binder are combined to form a composition that
6 is used to formulate a tablet in order to increase the
7 weight and/or density of the tablet. In another embodiment,
8 a binder and a portion of an active ingredient or diluent of
9 a capsule are mixed to form a solid which when dried, is
10 added to the other portions of capsule ingredients thereby
11 eliminating the need for a filler.

12 It is to be understood that any of the aforementioned
13 methods and techniques of the present invention may be used
14 in any combination to increase the weight and/or density of
15 an oral dosage form.

16 It is to be understood that for purposes of
17 facilitating understanding of the present invention, the
18 ensuing description describes the liquid with which the oral
19 dosage form is taken as water. However, it is to be
20 understood that other liquids may be used, e.g. soda, juice,
21 coffee, etc. and that the weight and/or density of the oral
22 dosage form may have to be increased in accordance with the
23 present invention to eliminate buoyancy of the oral dosage
24 form on those types of liquids.

1 The instant specification describes inactive
2 ingredients (e.g. excipients) that are used in the
3 production of oral dosages. In a preferred embodiment, such
4 excipients are commercially available accepted
5 pharmaceutical excipient materials. In a most preferred
6 embodiment, such excipients do not contain fatty acids or
7 oils or waxes since such substances do increase buoyancy
8 which is contrary to the objects of the present invention.

9 In order to facilitate understanding of the present
10 invention, the ensuing description is divided into separate
11 discussions of each of the three types of oral dosage forms:
12 (1) capsules, (2) tablets and caplets, and (3) soft-gels.

13

14 1) Capsules

15 As discussed in the foregoing description, conventional
16 capsules, in effect, are sealed powder and air which have
17 significant buoyant characteristics. In accordance with one
18 embodiment of the present invention, a capsule is provided
19 which is configured to have a weighted or high-density end
20 portion. At least the weighted end portion of the capsule
21 sinks below the surface of the liquid with which the capsule
22 is taken. It has been found that sinking of at least the
23 weighted end portion of the capsule in the liquid results in
24 a significant improvement in the swallowability of the

1 capsule without compromising other characteristics that
2 consumers find favorable, e.g. shiny, smooth capsule
3 surface. In accordance with this embodiment of the present
4 invention, capsules are configured to have a relatively
5 greater weight and/or density than water (the density of
6 water is 1g/ml @ 4° Celsius) without increasing the size of
7 the capsule beyond consumer preference.

8

9 Example 1

10 A typical conventional capsule of 50 mg of the popular
11 nutritional supplement zinc contains excipients that weigh
12 462 mg. Its total weight is 512 mg in a size 0 capsule with
13 a volume of 0.68 ml and has a density D of 0.512 g/0.68 ml
14 or 0.75 g/ml. Since the density of this capsule is less
15 than 1 g/ml, it will float on water. In accordance with the
16 present invention, the density D of the capsule is increased
17 about 0.29 g/ml by the addition of a solid sucrose filler
18 weighing 250 mg at 0.1 ml. As a result, the end product
19 (i.e. the modified capsule) will weigh 762 mg at a volume of
20 0.73 ml. Due to compression in the filling process, the
21 capsule will only expand 0.05 ml. Thus, the density-
22 augmented capsule will now have a density D equal to 0.762
23 g/0.73 ml, or 1.04 g/ml. The density-augmented capsule will
24 sink in the water with which it is swallowed thereby

1 overcoming the problems associated with capsule buoyancy
2 discussed in the foregoing description. Specifically, the
3 density-augmented capsule will significantly reduce the
4 probability of the capsule moving out of correct alignment
5 and being swallowed at an uncomfortable angle. It is to be
6 understood that the density of the density-augmented capsule
7 can be further augmented. However, in a preferred
8 embodiment, the density augmentation is such that it does
9 not increase the size of the capsule beyond that which can
10 be comfortably swallowed by consumers. However, it is to be
11 understood that in the case of a veterinary application,
12 particular animals may be able to swallow capsules having a
13 size greater than the size preferred by consumers.

14 In Example 1 in the foregoing description, 250 mg or
15 32% of the total weight of the end product is the result of
16 the addition of the solid sucrose filler. Since the range
17 of capsule weight and density varies, the amount of the
18 filler needed to achieve the objects of the present
19 invention will also vary. In a preferred embodiment, the
20 percentage of the total weight of the oral dosage form that
21 is due to the weight of the digestible substance is between
22 about 5% and 90%. In one embodiment, the percentage of the
23 total weight of the end product that is due to the addition
24 of the filler ranges between 15% and 80%, inclusive. In

1 another embodiment, the percentage of the total weight of
2 the end product that is due to the addition of the filler
3 ranges between 25% and 50%, inclusive, if the filler is used
4 exclusively.

5 Example 2

6 In this example, the 512 mg weight of the conventional
7 capsule described in Example 1 is significantly increased at
8 the same volume by exchanging its powdered diluent for solid
9 granules. Specifically, the 200 mg of rice flour power
10 diluent is replaced by 400 mg of sucrose solid granules.
11 The sucrose solid granules require the same amount of space
12 but weigh twice as much as the rice flour diluent. Thus,
13 the weight of the capsule is increased to 712 mg at the same
14 volume with a density D of 0.712 g/0.68 ml or 1.04 g/ml.
15 Thus, the weight-augmented capsule will sink in water.

16

17 Example 3

18 In this particular example, a binder is used to produce
19 a capsule having a relatively greater density. For this
20 particular example, the conventional zinc capsule described
21 above in Example 1 contains about 112 mg of powder zinc and
22 other excipients and about 400 mg of the rice flour diluent.
23 In this example, increasing the density of the capsule in
24 accordance with the present invention comprises the

1 following steps:(a) subtracting 200 mg of the rice flour
2 diluent, (b) providing 200 mg of dry sorbitol,(c) mixing the
3 sorbitol with liquid to form a syrup-like binder, (d) mixing
4 the syrup-like binder with the remaining 200 mg of rice
5 flour, (e) drying the mixture of the syrup-like binder and
6 the rice flour, (f) forming granules from the dried mixture,
7 and (g) adding the granules to the 112 mg of powder zinc and
8 remaining excipients. As a result, the total capsule weight
9 remains about the same but the volume of the capsule
10 ingredients (zinc, excipients and binder) shrinks or
11 decreases 0.2 ml allowing the use of smaller capsule
12 portions. The density D of the end product will be 0.512
13 g/0.5 ml or 1.024 g/ml. This density is more than
14 sufficient to allow the capsule to sink in water. If water
15 is to be used as the liquid medium with which the capsule is
16 taken, then it is preferable that the density of the capsule
17 be increased to a density that is greater than 1 g/ml so as
18 to effect sinking of substantially the entire capsule in the
19 water. However, it is to be understood that the density of
20 the capsule, or of any of the oral dosage forms, can be
21 increased in accordance with the present invention to effect
22 sinking of the oral dosage form in other types of liquids,
23 e.g. soda, juices, coffee, milk, etc.

1 In an alternate embodiment of the present invention,
2 filler is placed in the body portion of the capsule along
3 with the ingredients. The cap portion is then attached to
4 the body portion. In such a configuration, the size of the
5 body portion is increased (e.g. elongated) so as to enable
6 filler and ingredients to fit in the body portion. In
7 accordance with such an alternate embodiment, a solid filler
8 of micro-crystalline cellulose or lactose is inserted into
9 the body portion before the empty capsules are shipped. In
10 a preferred embodiment, adhering agents are used. In order
11 to achieve maximum effect, a maximum weight and volume of
12 filler should be used with a given capsule size thereby
13 creating a system of standardization of filler sizes and
14 corresponding increased capsule sizes.

15 The following example illustrates the embodiment of the
16 present invention wherein the filler is placed or positioned
17 in the cap portion of the capsule.

19. *Example 4*

A typical conventional capsule of 50 mg of the popular nutritional supplement zinc contains excipients that weigh 462 mg. Its total weight is 512 mg in a size 0 capsule with a volume of 0.68 ml and has a density D of 0.512 g/0.68 ml or 0.75 g/ml. Since the density of this capsule is less

1 than 1 g/ml, it will float on water. In accordance with the
2 present invention, the density D of the cap portion of the
3 capsule is increased from approximately zero, when it is
4 empty, to about 2.5 g/ml by the addition of a solid sucrose
5 filler weighing 250 mg at 0.1 ml. As a result, the cap
6 portion of the end product (i.e. the modified capsule) will
7 sink below the surface of the water with which the capsule
8 is ingested thereby overcoming the problems associated with
9 capsule buoyancy discussed in the foregoing description.
10 Specifically, as a result of the cap portion sinking in the
11 water, the density-augmented capsule properly aligns itself
12 such that the whole capsule is parallel with the esophagus
13 thereby preventing the capsule from being swallowed at an
14 uncomfortable angle. Furthermore, the density-augmented
15 capsule travels directly down the esophagus and is not left
16 behind to stick to the esophagus surface.

17

18 Example 5

19 A 0.500 ml size #1 capsule is typically used to fill
20 400 mg of ingredients. In accordance with this embodiment
21 of the present invention, the size of the capsule is
22 increased to a size #00 with a 0.950 ml capacity. The
23 additional 0.450 ml of volume is used for the filler. When
24 a filler having a density of 1.5 g/ml is used, the extra

1 0.450 ml volume would accommodate a filler weighing 675 mg.
2 Thus, standardization can be achieved for any size capsule.

3 In another embodiment of the present invention, a size
4 #00 capsule is configured to have an elongated geometry so
5 as to provide a further 0.135 ml of volume or 14% increase
6 in space) for a filler weighing 202 mg. As used herein, the
7 designation "el" refers to such elongated capsule geometry.
8 Referring to FIG. 14, there is shown a table that shows
9 typical commercially available capsule sizes and
10 corresponding capsule volumes. Referring to FIG. 15, there
11 is shown a table that shows specific filler weights, filler
12 volumes and corresponding increased capsule sizes in
13 accordance with the present invention. The additional
14 filler increases the density of the finished capsule to a
15 density that is substantially close to or above the density
16 of water. Lactose or micro-crystalline fillers have a
17 density of 1.5 in solid form. Thus, in accordance with the
18 present invention, FIG. 16 shows a standardization table for
19 this type of filler (i.e. having a density of 1.5 in solid
20 form) for each respective capsule size. Referring to FIG.
21 17, there is shown a table that shows new capsule sizes, and
22 the amount of additional filler that can be added to the new
23 sized capsules and the resulting total filler weight. As
24 shown in FIGS. 16 and 17, capsule sizes 4 and 5 are

1 increased to size 2. The difference in a size 5 capsule and
2 a size 2 capsule is 0.24 ml which will accommodate a filler
3 weight of 360 mg (0.24 ml x 1.5 mg (solid filler density)).
4 The difference in a size 4 capsule and a size 2 capsule is
5 0.16 ml which can accommodate a filler weight of 0.16 ml x
6 1.5 mg = 240 mg.

7 Referring to FIGS. 18A, 18B and 18C, in accordance with
8 the present invention, there is shown a conversion table
9 that shows initial capsule sizes and various powder density
10 and weights that can be achieved with each particular
11 initial size capsule, and new capsule sizes and the various
12 total densities and weights that can be achieved with each
13 new capsule size. As shown in FIGS. 18A, 18B, and 18C, the
14 various total densities and weights that can be achieved
15 with each new capsule size are relatively greater than the
16 densities and weights that are possible for the
17 corresponding initial capsule sizes. Thus, the table of
18 FIGS. 18A, 18B, and 18C provides a standardization system
19 which provides seven (7) capsule sizes that accommodate the
20 standard capsule sizes at four or more powder densities.
21 Thus, the increase in densities is clearly demonstrated.

22 In order to produce the oral dosage forms in accordance
23 with the present invention, particular, pertinent and novel

1 manufacturing steps are implemented. These steps are
2 described in the ensuing description.

3 Capsules typically are comprised of two portions (i.e.
4 body portion and cap portion) that are pushed together to
5 enclose the capsule ingredients. The capsule portions are
6 pushed together by applying a predetermined force. This
7 type of "enclosing" technique does not employ any steps to
8 seal the capsule portions together after the predetermined
9 force is applied. However, it has been found that the force
10 currently being used in conventional processes to compress
11 the ingredients to an effective density is not sufficient
12 because the capsule ingredients tend to bounce back when the
13 capsule portions are not sealed together. The method of the
14 present invention includes a particular step that pertains
15 to the application of such force. Specifically, the method
16 of the present invention includes the step of applying a
17 relatively greater force to the capsule portions, in
18 comparison to the force applied in conventional capsule
19 fabrication processes, in order to extract substantially all
20 of the air from the powdered ingredients. The extraction of
21 air from the interior of the capsule facilitates
22 swallowability of the capsule. Furthermore, the increased
23 force facilitates the positioning of the filler and the
24 ingredients within the capsule volume.

1 In another embodiment of the method of the present
2 invention, the capsule portion holding the ingredients is
3 configured to have a deeper well to accommodate the filler
4 material. This is illustrated in FIG. 1. Capsule 10
5 generally comprises cap portion 12 and body portion 14.
6 Body portion 14 holds the ingredients during the filling
7 process. In one embodiment, body portion 14 is configured
8 to have a relatively deeper "well" in order to accommodate
9 filler material or a binder that is used to increase the
10 weight and/or density of the capsule in accordance with the
11 present invention. In such an embodiment, the length of
12 body portion 14 is increased or elongated to accommodate
13 filler material or binders. In another embodiment, the
14 length of cap portion 12 is increased or elongated to
15 accommodate filler material or binders. In yet a further
16 embodiment, the diameter of portions 12 and 14 are increased
17 to accommodate larger amounts of filler materials or
18 binders.

19 The filler may be configured to have any suitable
20 shape. However, it has been found that if a single piece of
21 solid filler is used in a capsule, then the preferred shape
22 of the solid filler should be generally spherical or oval in
23 order to facilitate compacting powder ingredients and
24 filling air gaps. In one embodiment, the filler is covered

1 with a film material that prevents it from interacting with
2 the ingredients.

3 In a further embodiment of the method of the present
4 invention, the capsule components, e.g. portions 12 and 14,
5 are formulated to have a relatively greater thickness to
6 provide relatively greater strength to withstand the greater
7 force resulting from addition of the filler. Furthermore,
8 it is to be understood that the added thickness of the
9 capsule portions also contributes to the increase in weight
10 and density of the capsule in accordance with the present
11 invention.

12 In another embodiment of the method of the present
13 invention, a sealing process is used to hold the joined
14 capsule portions in place. Specifically, this sealing
15 process comprises the step of applying an adhering agent
16 around the seam of the filled and joined capsule portions.

17 In a further embodiment, a locking process is used to
18 hold the joined capsule portions in place. In such a
19 process, indentations or moldings are formed on the capsule
20 cap and body. The indentations or moldings are used to lock
21 the cap and body together. A plurality of indentations or
22 moldings can be used to provide capsules of varying lengths.

23 In yet another embodiment of the method of the present
24 invention, when the weight of the capsule is increased to

1 improve swallowability, as described above, the weight is
2 concentrated at one end of the capsule. When such a
3 configuration is used, markings or indicia are applied to
4 the weighted portion of the capsule so as to indicate the
5 weighted portion of the capsule. Such a configuration is
6 shown in FIG. 2. Capsule 20 comprises cap portion 22 and
7 body portion 24. Portion 22 has indicia 26 to indicate that
8 portion 22 is the weighted portion and that capsule 20
9 should be placed in the consumer's mouth so that weighted
10 portion 22 is pointing toward the opening of the esophagus.
11 In one embodiment, the indicia 26 consist of a color.
12 However, it is to be understood that other types of indicia
13 can be used, e.g. letters, numbers, etc.

14 Referring to FIG. 3, as described in the foregoing
15 description, granules of a particular substance, e.g.
16 sucrose solid granules, are added to the capsule to increase
17 the weight and/or density of the capsule. Thus, in this
18 embodiment of the method of the present invention, the
19 method comprises the steps of (a) providing capsule 30 that
20 comprises capsule portions 32 and 34, (b) retaining portion
21 34 so that it is stationary, (c) depositing ingredients 35
22 into portion 34, (d) depositing granules 36 into portion 34,
23 and (e) joining capsule portions 32 and 34 together. In
24 another embodiment, this particular method includes the step

1 of applying indicia to the weighted portion of capsule 30 in
2 a manner described above.

3 Referring to FIG. 4, the method of the present
4 invention also provides particular steps for using a single
5 piece of filler substance. Specifically, these particular
6 steps comprise (a) providing capsule 40 that comprises cap
7 portion 42 and body portion 44, (b) retaining body portion
8 44 so that it is stationary, (c) depositing ingredients 45
9 into body portion 44, (d) depositing single filler substance
10 46 into body portion 44, and (e) joining cap portion 42 to
11 body portion 44. In one embodiment, single filler substance
12 46 is deposited into body portion 44 by capsule filling
13 machines known in the industry. In one embodiment, this
14 method includes the step of applying indicia to the weighted
15 portion of capsule 40 in a manner as described above. In
16 one embodiment, the predetermined weight and concentration
17 of the filler in portion 44 produces a density of portion 44
18 that is at least 1.0 g/ml.

19 In a further embodiment of the present invention, a
20 capsule is configured to have a body portion (e.g. portion
21 44) that is sized to contain the active ingredients, any
22 required inactive ingredients, and the filler, and a flat
23 cap portion (not shown) that is used to seal the body

1 portion thereby substantially eliminating any air pockets or
2 air reservoir.

3 Referring to FIG. 5, in another embodiment of the
4 method of the present invention, a method is provided for
5 adding or attaching a filler to the exterior of either
6 capsule portion. Specifically, this method comprises the
7 steps of (a) providing capsule 60 that comprises capsule
8 portions 62 and 64, (b) retaining portion 64 so that it is
9 stationary, (c) depositing ingredients 66 into portion 64,
10 (d) adhering or attaching filler substance 68 to the
11 exterior surface of portion 62; and (e) joining capsule
12 portions 62 and 64 together.

13 Referring to FIG. 6, in a further embodiment of the
14 method of the present invention, a method is provided for
15 molding a filler substance into either of the capsule
16 portions. Specifically, this method comprises the steps of
17 (a) providing capsule 80 that comprises capsule portions 82
18 and 84, (b) retaining portion 84 so that it is stationary,
19 (c) depositing ingredients 86 into portion 84, (d) molding
20 filler substance 88 into portion 82, and (e) joining
21 capsule portions 82 and 84 together. In an alternate
22 embodiment of this method, the filler substance 88 is
23 adhered to the inside of either of the capsule portions. In
24 another embodiment, the body portion or cap portion, or

1 both, are molded to have a portion comprised of the filler
2 substance. In a further embodiment of the present
3 invention, one or both of the capsule portions are formed
4 from the filler substance. Thus, in such an embodiment, the
5 entire capsule, i.e. both body and cap portions, are made
6 from the filler substance.

7 Referring to FIG. 13, there is shown a further
8 embodiment of the present invention. Density-augmented
9 capsule 400 comprises body portion 402 having an interior
10 for containing ingredients 403 (e.g. active ingredients and
11 any inactive ingredients), and cap portion 404 having an
12 interior 405 for receiving filler substance 406 (shown in
13 phantom). Filler 406 can be in solid, semi-solid or paste
14 form. Preferably, filler substance is digestible. Thus, in
15 accordance with the invention and the embodiment shown in
16 FIG. 13, the following method is provided (a) providing
17 capsule 400 that comprises capsule body portion 402 and cap
18 portion 404 which has interior 405, (b) retaining body
19 portion 402 so that it is stationary, (c) depositing
20 ingredients 403 into the interior of body portion 402, (d)
21 depositing filler substance 406 into interior 405 of cap
22 portion 404, and (e) joining cap portion 404 to body portion
23 402.

1 In another embodiment of the present invention, the
2 solid or semi-solid filler is placed or positioned only in
3 the interior of the body portion of the capsule. In a
4 further embodiment, solid or semi-solid filler is placed in
5 both the interiors of the cap and body portions of the
6 capsule.

7 In yet another embodiment, a capsule is configured to
8 comprise a body portion for containing the active
9 ingredients and a plug portion. The plug portion is formed
10 from a filler substance. The filler substance can be in
11 solid form or paste form. This embodiment is shown in FIGS.
12 11 and 12. Capsule 300 comprises body portion 302 and plug
13 portion 304. Body portion 302 has an opening 306 and
14 contains the active ingredients. Plug portion 304 is formed
15 from the filler and is inserted into opening 306. The size
16 of plug portion 304 is chosen so as to create a frictional
17 fit between the plug portion 304 and body portion 302. The
18 amount of active ingredients and the size of plug portion
19 304 are chosen so as to substantially eliminate air pockets
20 within capsule 300. In a further embodiment, body portion
21 302 is elongated or lengthened, in comparison to
22 conventional capsule body portions, so as to accommodate the
23 active ingredients and plug portion 304. Plug portion 304
24 can be plugged or inserted into body portion 302 by

1 mechanical means such as typical capsule filling machines
2 which are known in the industry. An advantage of capsule
3 300 is that plug portion 304 renders a typical gelatin cap
4 unnecessary.

5 The solid filler described above can be standardized in
6 order to facilitate automated manufacturing processes. The
7 solid filler can be adhered to the inside of the cap portion
8 of the capsule while the cap portion is still empty.
9 Capsules typically are manufactured in standard sizes so
10 that they may be handled by automatic filling machines.

11 The feature of concentrating the filler at one end of
12 the capsule provides many advantages. One such advantage is
13 that the end of the capsule having the filler becomes
14 submerged in the liquid even if the total density of the
15 capsule does not exceed that of water. This advantage
16 results from the proportionally larger weight of the "filler
17 end" of the capsule. Even if the lighter end of the capsule
18 having the powder ingredients still floats, the
19 effectiveness of the capsule of the present invention is
20 still achieved by the weighted filler end of the capsule
21 being submerged. Another advantage is the improved
22 swallowability of the capsule. A further advantage is that
23 the proportionally larger weight of the filler end of the
24 capsule counteracts the buoyancy caused by air bubbles that

1 may be created when the cap portion of the capsule is joined
2 with the body portion.

3 In a further embodiment, the cap portion of the capsule
4 is configured so as to substantially degrade the formation
5 of any bubbles therein when the cap portion of the capsule
6 is joined with the body portion. In one embodiment, this is
7 achieved by configuring the end of the cap portion to have a
8 generally flat geometry rather than a curved or rounded end.
9 In another embodiment, the interior portion of the cap
10 portion that is adjacent to the end of the cap portion is
11 filled in with the same material used to formulate the cap
12 portion.

13

14 2) Tablets and Caplets

15 In accordance with the present invention, tablets and
16 caplets are produced with relatively greater weight and
17 density to improve swallowability of the tablets and/or
18 caplets. The increase in weight and density is accomplished
19 by adding a filler as described above. In one embodiment,
20 the filler is added to the ingredients. For example, in one
21 embodiment, a solid sucrose filler is molded in with the
22 ingredients. In another example, the filler is embedded
23 within the tablet ingredients.

1 In another embodiment, the tablet or caplet is
2 configured such that the active ingredients and any inactive
3 ingredients are embedded in a filler substance. This
4 example is illustrated in FIG. 7. Tablet 90 comprises
5 portions 92 and 94. Portion 92 is comprised only of filler.
6 Portion 94 is embedded within the filler. Portion 94
7 comprises the active ingredients and any inactive
8 ingredients.

9 In yet another embodiment, the tablet is configured
10 such that one side, end or portion of the tablet has
11 concentrated weight and has indicia to indicate which side,
12 end or portion has the concentrated weight.

13 In a further embodiment, increasing the weight and
14 density of the tablet or caplet is accomplished by
15 increasing a component of the tablet or caplet. In one
16 embodiment, this is accomplished by increasing the weight of
17 an excipient such as the binder ingredient.

18 In a preferred embodiment, the percentage of the total
19 weight of the end product that is due to the addition of the
20 filler, or the increase in the weight of the component, is
21 between about 15% and 90%, inclusive. More preferably, the
22 percentage of the total weight of the end product due to the
23 addition of the filler or increase in the weight of the
24 component is between about 25% and 75%, inclusive. For

1 example, 50% of the weight of a 400 mg tablet augmented with
2 200 mg of filler is the result of adding the filler. In
3 this example, the original weight of the tablet has been
4 doubled or increased about 100%.

5 The increase in weight and/or density provides
6 significantly improved swallowability of particularly light,
7 small sized tablets and caplets (i.e. under 300 mg, 4/10
8 ml).

9 Referring to FIGS. 9 and 10, there are shown alternate
10 embodiments of the tablets and caplets of the present
11 invention. These embodiments utilize a particular shape
12 having a swelled end which is substantially larger than the
13 opposite end. For example, FIG. 9 shows a conical-shaped
14 tablet or caplet 200 which has swelled or enlarged end 202
15 and a relatively narrow end 204. Filler 206 is dispersed
16 throughout tablet or caplet 200. Figure 10 shows a
17 generally-trapezoidal shaped tablet or caplet 208 which has
18 a swelled or enlarged end 210 and a relatively narrow end
19 212. Similarly, filler 214 is dispersed throughout the
20 tablet or caplet 208. As a result of the shape of tablets
21 or caplets 200 and 208, swelled ends 202 and 210,
22 respectively, are substantially heavier than the opposite
23 narrow ends. Thus, the swelled or enlarged ends sink in the
24 liquid with which the tablet or caplet is taken thereby

1 effecting correct alignment of the tablet or caplet and
2 movement of the tablet or caplet through the throat and into
3 the esophagus.

4
5 3) Softgels

6 In accordance with the present invention, the weight of
7 softgels is increased to improve swallowability thereof. In
8 one embodiment of the present invention, increasing the
9 weight of softgels is accomplished by the addition of a
10 filler substance. Specifically, the filler is added to the
11 ingredients, e.g. a solid sucrose portion. This is
12 illustrated in FIG. 8. Softgel 100 comprises portions 102
13 and 104. Portion 102 is comprised only of ingredients.
14 Portion 104 includes filler 106. In one embodiment, filler
15 106 is comprised of solid sucrose.

16 In another embodiment of the present invention,
17 increasing the weight of softgels is accomplished by
18 increasing the amount of a component. For example, if the
19 component is a liquid excipient, then the amount of the
20 excipient is increased. Increasing the amount of the
21 component can also be realized by increasing the size or
22 thickness of the softgel.

1 In another embodiment, the softgels can be configured
2 so that one side or portion of the softgel has concentrated
3 weight and has indicia to indicate this end.

4 In a preferred embodiment, the percentage of total
5 weight of the softgel that is due to the addition of the
6 filler or increase in component is between about 15% and
7 90%, inclusive. More preferably, the percentage of total
8 weight of the softgel that is due to the addition of the
9 filler or increase in component is between about 25% and
10 75%, inclusive.

11 The increase in weight and/or density provides
12 significantly improved swallowability of particularly light,
13 small sized softgels (i.e. under 300 mg, 4/10 ml).

14 Gravity plays a significant role in the process of
15 swallowing food. The role of gravity in swallowing food is
16 described in *The Human Body, Volume on "Digestion"*, pp. 60-
17 61, Torstar Books, 1984 and in *The ABC's of the Human Body*,
18 Reader's Digest General Books, page 240, 1987. The
19 relatively greater weight and/or density of the oral dosage
20 forms of the present invention effect augmentation of the
21 gravitational force that facilitates the downward passage of
22 the oral dosage forms. Thus, the swallowability of the oral
23 dosage forms is significantly increased.

1 Thus, the present invention provides new and improved oral
2 dosage forms that:

- 3 a) solve the aforementioned problems discussed above that
4 relate to the swallowability of oral dosage forms;
- 5 b) can be provided in the form of capsules, tablets,
6 gelcaps and softgels;
- 7 c) interact with gravity to facilitate prompt and direct
8 movement of the oral dosage form to the opening of and
9 through the esophagus;
- 10 d) results in a relatively faster dissolution rate of the
11 oral dosage form and relatively faster absorption rate
12 of the medication provided by the oral dosage form;
- 13 e) can be produced with commercially available
14 ingredients; and
- 15 f) can be produced without exorbitant manufacturing costs.

16 The principles, preferred embodiments and modes of
17 operation of the present invention have been described in
18 the foregoing specification. The invention which is
19 intended to be protected herein should not, however, be
20 construed as limited to the particular forms disclosed, as
21 these are to be regarded as illustrative rather than
22 restrictive. Variations in changes may be made by those
23 skilled in the art without departing from the spirit of the

1 invention. Accordingly, the foregoing detailed description
2 should be considered exemplary in nature and not limited to
3 the scope and spirit of the invention as set forth in the
4 attached claims.

5 Thus, having described the invention, what is claimed
6 is: